THE

AMERICAN JOURNAL

OF THE MEDICAL SCIENCES

FOR OCTOBER 1869.

ART. I.—*A Contribution to the Clinical History of Variolous Disease occurring in Children and Minors.* By WILLIAM PEPPER, M. D., one of the Physicians to the Philadelphia Hospital.

DURING the early months of the year 1865, a severe epidemic of variola prevailed throughout the city of Philadelphia, and as, at that time, I was Visiting Physician in the Southwestern District of the Philadelphia Dispensary, a large number of cases of the disease came under my care.

A considerable number of adults were attacked, but by far the greater proportion of the cases occurred in children under the age of 15 years. Finding that I had preserved quite full notes of 30 such cases, I have been led to tabulate them, together with 3 cases occurring between the ages of 15 and 20 years, in the hope that the conclusions following from their study might possess some clinical interest.

The following list presents the mere headings of the cases which have served as the basis of the present article :—

			FORM OF DISEASE.	PREVIOUS VACCINATION.	RESULT.
1.	Female,	æt. 5 mos.,	discrete varioloid, primary,	never,	convalesced on 7th day.
2.	Male,	“ 3 years,	“ “ “	during incubation, but did not take,	“ “ 10th “
3.	Female,	“ 4 “	“ “ “	2 years before,	“ “ 10th “
4.	Male,	“ 8 “	“ “ “	in infancy, but did not take,	“ “ 6th “
5.	Female,	“ 9 “	“ “ “	in infancy, successfully,	“ “ 8th “
6.	Male,	“ 11 “	“ “ “	in infancy, successfully,	“ “ 12th “
7.	Female,	“ 11 “	“ “ “	in infancy, successfully,	“ “ 9th “
8.	Female,	“ 14 “	“ “ “	at age of 1 yr. successfully,	“ “ 14th “
9.	Male,	“ 14 “	“ “ “	not known,	“ “ 6th “
10.	Male,	“ 15 “	“ “ “	at age of 5 yrs. successfully,	“ “ 16th “
11.	Female,	“ 6 mos.,	confluent variola, “	never,	death “ 16th “
12.	Female,	“ 9 “	“ “ “	never,	“ “ 7th “
13.	Male,	“ 1 year,	“ “ “	twice, but without taking,	“ “ 9th “
14.	Male,	“ 1 “	“ “ “	never,	convalesced “ 23d “

			FORM OF DISEASE.			PREVIOUS VACCINATION.	RESULT.			
15.	Male,	æt. 21 mos.,	confluent	variola,	primary,	5 days before first symptoms, but without success,	convalesced	on	17th	day.
16.	Male,	" 2 years,	"	"	"	never,	"	"	15th	"
17.	Female,	" 2 "	discrete	"	"	never,	"	"	16th	"
18.	Female,	" 3½ "	confluent	"	"	never,	death	"	16th	"
19.	Male,	" 4 "	"	"	"	never,	"	"	14th	"
20.	Female,	" 5 "	discrete	"	"	2 years previously,	convalesced	"	15th	"
21.	Female,	" 6 "	confluent	"	"	never,	"	"	21st	"
22.	Female,	" 7 "	discrete	"	"	in infancy, successfully,	"	"	17th	"
23.	Female,	" 8 "	"	"	"	in infancy, successfully,	"	"	18th	"
24.	Male,	" 8 "	"	"	"	never,	"	"	18th	"
25.	Female,	" 8 "	"	"	"	never,	"	"	16th	"
26.	Male,	" 11 "	confluent	"	"	in infancy, successfully,	"	"	20th	"
27.	Female,	" 12 "	discrete	"	"	never,	"	"	24th	"
28.	Male,	" 13 "	"	"	secondary,	in infancy, successfully,	"	"	20th	"
29.	Male,	" 13 "	confluent	"	primary,	in infancy, successfully,	"	"	20th	"
30.	Male,	" 15 "	"	"	"	at age of 2 yrs. successfully,	"	"	21st	"
31.	Female,	" 18 "	discrete	"	"	at age of 5 yrs. successfully,	"	"	21st	"
32.	Female,	" 18 "	confluent	"	"	in infancy, successfully,	"	"	21st	"
33.	Male,	" 20 "	"	"	"	never,	"	"	24th	"

Form of Disease.—It will be seen that this list includes 33 cases of variolous disease; 10 of which were cases of discrete varioloid; 9 of discrete and 14 of confluent variola. In all but one case the disease was primary and appeared in the midst of ordinary health. In the single secondary case (No. 28) the attack of discrete variola appeared in a lad of 13 years, during convalescence from a severe attack of typhus fever.

Sex.—There is no acute disease upon which mere sex has less influence than variola. It frequently occurs that in long series of cases the number of patients of either sex is very nearly if not exactly the same—and thus, among the 33 cases tabulated above, there were 16 males and 17 females.

Colour.—Among the 33 cases all but 4 occurred in white children, a fact which is not discordant with the well-known susceptibility of the negro race to the variolous poison, inasmuch as the district of the city in which these cases were observed is peopled almost exclusively by whites. In other portions of the city, where there are numerous negroes, variola was extremely abundant and very severe during the same period.

Constitution.—The constitution and general health of the children was noted in 21 cases; of these 18 are recorded as being of good constitution, 3 as being delicate. The temperament was noted in 17 cases, of which 11 were markedly *lymphatic;* and 6 decidedly, and in two or three instances excessively, *nervous.*

Age.—Unlike sex, the influence of age upon the development and type of variolous disease is strongly marked. The question as to how far this is due to the usual early performance of vaccination will be discussed hereafter. Of the above 33 cases, 5 occurred in children under 1 year of age; 3 in those between 1 and 2 years; 1 between 2 and 3 years; 2 between 3 and 4 years; 2 between 4 and 5 years; 7 between 5 and 10 years; 10 between 10 and 15 years; 3 between 15 and 20 years. Or, in the first period of 5 years, there were 13 cases; in the second, 7; in the third, 10; and in the fourth, 3.

It is interesting to observe also the relative frequency with which variola and varioloid occur at these respective ages. Of 10 cases of varioloid, 1 occurred in the first year of life (at 5 months); 1 between 2 and 3 years; 1 between 4 and 5 years; 2 between 5 and 10 years; and 5 between 10 and 15 years. While, on the other hand, of 23 cases of variola, 4 occurred in the first year of life (at 5, 9, 12, 12 months respectively); 3 between 1 and 2 years; 2 between 3 and 4 years; 1 between 4 and 5 years; 5 between 5 and 10 years; 5 between 10 and 15 years; and 3 between 15 and 20 years. Or, in other words, variola was three times as frequent in the first two years of life as varioloid; equally frequent between 5 and 10 years; and less than half as frequent between 10 and 15 years.

Leaving aside for the moment the modifying influence of vaccination, we see a ready explanation of the fact that variolous disease is most frequent in the first two or three years of life, and again in the period between 5 and 10 years, in the great susceptibility of very young children who have not been vaccinated, and, on the other hand, in the free exposure to contagion which is furnished children of the latter age in schools and factories.

Vaccination.—When, however, we also take into account the influence of vaccination, it affords an additional explanation of the distribution of these affections with regard to age; while, at the same time, we are enabled to gain a clear idea of the positive value of this proceeding. Thus, we find that of 10 cases of varioloid, it is not known in 1 case whether vaccination had been performed; in 6 it had been performed successfully; in 1 it had been twice performed, but without success; and in 2 cases it had never been performed.

In the 6 cases which had been successfully vaccinated, varioloid occurred at the age of 4, 9, 11, 11, 14, and 15 years; the operation of vaccination having been performed at a distance of about 2, 7, 10, 10, 13, and 14 years respectively. In the case where it had been unsuccessfully performed the child was 8 years old. The only 2 cases of varioloid which occurred under the age of 4 years had never been vaccinated; one of them was, however, vaccinated during the incubation of the disease, but there was not the least local symptom following the insertion. Finally, it remains to be said that all the cases of varioloid were discrete, and recovered speedily without disfiguration.

On the other hand, out of 23 cases of variola 12 had never been vaccinated at all; 1 was vaccinated during incubation, but without effect; 1 had been twice unsuccessfully vaccinated; and 9 had been successfully vaccinated. In these latter cases, the disease occurred at the ages of 5, 7, 8, 11, 13, 13, 15, 18, and 18 years; the operation of vaccination having been performed at a distance of about 2, 6, 7, 10, 12, 12, 13, 13, and 17 years respectively. In 5 of these 9 cases the eruption was discrete; in 4, it was confluent; in all of them recovery ensued. In the 14 cases which had not been successfully vaccinated, the disease occurred at the age of 6, 9, 12, 12, 21 months; 2, 2, 3½, 4, 6, 8, 8, 12, and 20 years; or, in other words, 9 children between the ages of 6 months and 4 years who had not been protected by vaccination were affected with variola; 5 cases only occurring in unprotected subjects after the latter age. In no case where vaccination had been successfully performed did variola occur under the age of 4 years. Of the 9 cases occurring under the age of 4 years the disease was confluent in 8, with a mortality of 5; and discrete in 1 case, which recovered. All the 5 cases over 4 years of age recovered, the disease being discrete in 4 and confluent in but 1.

In summing up these facts the following conclusions seem obvious:—

1. That vaccination appears to furnish almost complete protection against the occurrence of either varioloid or variola during the first six years of life; the importance of which result is enormously increased by the additional fact that all the fatal cases occurred under 4 years of age.

The only cases which necessitate a modification of the claim for vaccination of absolute protective power during the first 6 years of life are two: Nos. 3 and 20, one of discrete varioloid and one of discrete variola, in both of which vaccination had been performed two years previously. Although, as will be more fully discussed hereafter, there is some reason to assume that in these cases there may have been imperfection in the vaccination, I do not care to insist upon it. In case No. 13, however, where it was stated that vaccination had been twice unsuccessfully performed, and yet fatal confluent variola occurred at the age of twelve months, I can have little doubt that the failure of the operation was due to the employment of inert virus, or to the neglect of proper care on the part of operator or parent.

2. That in subjects not vaccinated, the greatest susceptibility to the variolous poison seems to be during the first two years of life, at which time the form of the disease is very apt to be confluent and in a large proportion of cases fatal. The same tendency for the disease to assume the grave confluent form of true variola in unprotected subjects may be seen, though to a less degree, at all ages: thus, in 16 cases at all ages, where vaccination had never been performed, there were but 2 cases of varioloid, while there were 4 cases of discrete and 10 of confluent variola. Eleven of these cases occurred under 4 years of age, 2 being cases of varioloid, 1 of discrete and 8 of confluent variola; while 5 occurred over 5 years of age, and presented 3 instances of discrete and 2 of confluent variola.

3. That when owing to any cause, whether from possible inertness of virus, imperfect insertion, or idiosyncrasy on the part of the subject, the vaccination fails, the operation should be repeated at short intervals, varying the virus and perhaps the mode of insertion, until success is obtained or all danger of exposure to contagion ceases. And in this latter case (see

No. 4) the attempt should be renewed after a few years' interval, or whenever the least danger of exposure to contagion arises.

4. That in very many cases, however successfully vaccination may have been performed, its protective power becomes exhausted after a number of years. In 15 cases where variolous disease occurred after successful vaccination, the interval was 2 years in 2 cases; 6, 7, and 8 years each in 1 case; and from 10 to 17 years in 10 cases. It would appear from this, that, although there is very little risk when vaccination has preceded the exposure to contagion by so short a period as 2 years, vaccination should still be practised to insure entire immunity, and that the necessity for revaccination becomes more and more urgent with every additional year's interval.

5. That when the protective power of vaccination has thus been in course of time exhausted, the subject may contract any form of variolous disease. Thus, of 15 cases occurring in those who had been successfully vaccinated, 6 were cases of discrete varioloid; 5 were cases of discrete, and 4 cases of confluent variola.

6. That, notwithstanding this possibility, the chances are very much more in favour of an attack of varioloid or a mild form of variola when the subject has been vaccinated successfully, no matter at how long a distance, than if this operation had never been performed. (See Conclusion 2.)

Thus, while of 16 cases occurring in unprotected subjects, there were only 2 cases of varioloid, but 4 of discrete and 10 of confluent variola, we see that of 15 cases which had been previously successfully vaccinated, there were 6 cases of varioloid; 5 of discrete and 4 of confluent variola.

7. That, although the above tables furnish meagre evidence of a positive kind as to the absolute power of vaccination to protect against death from variola, they furnish strong negative evidence in its favour. For we see that among children, unprotected by vaccination, under the age of 4 years, 8 cases of confluent and 1 case of discrete variola occurred with 5 deaths; while among the very much larger number of children of the same age exposed to the same contagion, but protected by previous vaccination, there occurred but two cases of variolous disease, and both of them mild and discrete varioloid.

8. The only observations which bear upon the question of the influence of vaccination performed during the incubation of variolous disease are Nos. 2 and 15; in the first of which it was performed almost two weeks before an attack of discrete varioloid, in a child 3 years old; and in the other, five days before the first symptom of an attack, which proved to be confluent variola, in a boy 21 months old.

There seems no longer room for doubt that, if vaccination is performed during the incubation of variola, at such a time that the vaccine eruption appears before the variolous, this latter will be modified, and, in the vast majority of cases, favourably.

But there is no reason to suppose that when the vaccine eruption does not make its appearance, as in the two cases here reported, the introduction of the virus modifies in the least degree the ensuing variola. The fact that one of the children so vaccinated was one of the only two cases of varioloid which occurred among 9 cases of variolous disease under the age of 3 years, is probably to be explained on the supposition that there existed so slight a susceptibility that the child would have contracted merely a modified form of variola; and that vaccination would have failed had it been performed several weeks earlier.

In the other case the operation of vaccination preceded the first marked symptoms of variola by only five days, a period too short to afford much hope of impressing the system. It must be added, that during the prevalence of this epidemic of variola, I vaccinated many children who were fully as much exposed to contagion as those whose cases form the basis of this article, and that in no instance, where the operation was successful, nor, in any other than the two above cases, where the system was unsusceptible to the vaccine virus, did the child contract any form of variolous disease.

Finally, it may safely be laid down as a rule of practice, that whenever an individual (especially a child) who has never been vaccinated or only at a distance of two or more years, has been exposed to the contagion of variola, vaccination should be immediately performed, unless it is positively known that the stage of incubation has so far advanced that the vaccine disease will not have time to be developed before the appearance of the variolous eruption, unless, in other words, the initial symptoms of the variolous disease have appeared. It will be remembered that Eichorn recommended the performance of vaccination during the prodromes, or even on the first day of the eruption of variola; but, so far as we are aware, no other observers have found this practice followed by favourable results.

It remains to consider the influence of vaccination upon the probability of disfiguration in any subsequent attack of variolous disease. Among the above cases, there were but three instances in which pitting occurred, no local application having been made with a view to prevent it, but in all of these the disfiguration was marked. Two of them occurred in children, aged 6 months and 6 years respectively, who had never been vaccinated; the third, in a girl of 18 years, who had been vaccinated successfully 17 years before. In two other cases, very slight disfiguration occurred despite the use of local applications; one of them was a lad, aged 18 years, who had been vaccinated 13 years before; the other a lad, aged 20 years, who had never been vaccinated.

It will be observed that in the arrangement of the list of cases, the form of the disease has served as the only basis of division, and the question of previous vaccination has been entirely neglected. It is true, that many authors limit the use of the word varioloid to the cases of variolous disease occurring in those who have been previously vaccinated; while some others include in addition the rare second attacks of variolous disease, whether the first attack has been caused by contagion or inoculation. It appears, however, that if by the term variola we intend to indicate a general disease characterized by certain definite symptoms, and running a definite course; and by the term varioloid, a general disease manifesting essentially the same symptoms as variola, but presenting important modifications of some of them; we should apply these terms to the corresponding groups of phenomena under whatever circumstances they may appear.

Thus we have applied the name Variola to all cases, whether occurring in those who had previously been vaccinated or not, in which the eruption developed regularly and passed through the various stages of the true variolous pock, in which the secondary fever was marked, and the duration of the case, unless cut short by death, was from fifteen to over twenty days, dating from the initial symptoms to early convalescence.

And, on the other hand, the name Varioloid has been applied to all cases, whether occurring in those who had previously been vaccinated or not, in which the eruption developed irregularly, its different stages being imperfectly marked and short, in which the secondary fever was either absent or slight, and in nearly all of which convalescence occurred within two weeks.

The degree of susceptibility of the system to the variolous poison is the all important question, and if this be very marked (no matter whether vaccination have never been performed, or, having been performed, its protective influence has to a great extent passed away), the resulting disease may present all the phenomena of grave variola, and is surely entitled to that name. Nor is this question merely a theoretical one; for the application of the name varioloid to all forms of variolous disease occurring after vaccination, certainly tends to create the impression that all such cases are necessarily mild, that their duration will be comparatively short, and that the eruption in particular will run through its stages rapidly, and leave no disfiguration. A glance at the symptoms in Nos. 28, 29, 31, 32, in all of which vaccination had been successfully performed in infancy, would suffice to show how extremely severe variola may be under such circumstances; and I regret to be able to quote No. 31 as a proof that previous vaccination is no sure protection against marked disfiguration in a subsequent attack of variola. When this case was first seen, the eruption was too far advanced to admit of any local applications to prevent pitting; but I am cognizant of at least three other cases in which, from a knowledge of the previous performance of vaccination, such applications were not employed, and where, in each case, extreme disfiguration resulted.

The above conclusions are merely confirmatory of those which have been previously obtained by the study of many thousands of cases in all parts of the world. While pointing out the facts that the protective power of vaccination is not always complete, and that it is very liable to become exhausted after the lapse of some years, they point out still more clearly the inestimable value of the operation.

It is a matter, therefore, not only of regret, that its advantages are not more universally obtained, but of the highest importance in a sanitary point of view, when we reflect upon the power of diffusion which a single case of variola possesses when occurring in a densely-populated city. It cannot be doubted, however, when we find that, of 33 cases of variolous disease occurring in a short period in the practice of one physician, vaccination had never even been attempted in 15—that there is a wide-spread neglect of this operation throughout, at least, the lower classes of this community. A further proof of this is furnished by the lists of mortality from variola, during past years in Philadelphia, taken in connection with the fact that successful vaccination is an almost sure protection against death from variola.

In the following table, the entire annual mortality from variola in Philadelphia, together with the relative mortality during the early years of life, is shown for the 20 years ending with 1868:—

	Under 1 year.	Between 1 and 2 yrs.	Between 2 and 5 yrs.	Total of all ages.
1848	21	13	17	100
1849	25	20	34	152
1850	13	8	5	40
1851	40	30	54	216
1852	89	54	100	427
1853	22	9	9	57
1854	12	4	6	49
1855	57	39	85	275
1856	86	44	88	390
1857	19	17	11	65
1858	1	2	1	7
1859	0	0	1	2
1860	14	10	16	57
1861	159	105	200	758
1862	52	44	66	264
1863	33	24	28	171
1864	57	31	61	260
1865	104	50	112	524
1866	32	17	27	144
1867	16	4	11	48
1868	0	0	0	1
First half of 1869	0	0	0	6

An inspection of this table undoubtedly establishes the fact that, whenever the contagious principle of variola, favoured by some peculiar epidemic influence, is introduced into this community, it finds a large number of unprotected children who fall ready victims to its attack.

In most instances, it is easy to trace the neglect of vaccination either to the reckless thoughtlessness or the ignorant prejudices of the parents.

The first of these causes of neglect is inseparably connected with the mental state of many of the lower classes; but the prejudices against the operation have unfortunately been, to a certain extent, encouraged by the action of some of the medical profession itself. Thus, in some cases, I have found that the prejudice has arisen from the highly exaggerated accounts given by some physicians, of the dangers of the transmission of syphilis or some other affection by means of vaccination. But far more frequently it has appeared to me to result from the manifestly imperfect manner of performance, or from the inert character of the virus employed. For, among comparatively unreasoning persons, it is evident that a single case of severe, unmodified variola, occurring in a child who shortly before has been vaccinated and nominally protected against such attacks, will excite a wide-spread and powerful prejudice against the operation. From some such causes it has constantly been the case for years past, that many parents, among the poorer classes, do not have their children vaccinated.

There is, indeed, every reason to hope that during the past few years this mischievous neglect has been growing less and less frequent—a result principally due to the establishment, by ordinance (dated, I believe, 1860) of official vaccinators in every district of the city, who vaccinate all who apply to them, with reliable virus, and free of charge.

It is evident, however, from the annual mortality since 1861, the year in which this vaccination ordinance went into effect, that it does not fully accomplish the desired purpose. For too great reliance must not be placed upon the unprecedentedly low mortality of 1868, since a glance at the above table of annual mortalities will show that, in 1859, there were but 2 deaths, but yet that in 1861 there were 758, and in 1865, 524 deaths.

The attempt has been made to derive some general law from these figures to explain their variations, and certainly the series appears to partly bear out the hypothesis of Prof. Jackson, that the disease presents cycles of 5 years' duration. Thus during the past 20 years it will be observed, that there are four separate cycles, in each of which the number of deaths increases until the 3d year, and then declines during 2 years in 2 instances, and during 1 year in the others.

During the past 7 or 8 years, however (including the period of the late war), it is true that there have been many disturbing elements which must have interfered with the regular working of any such uniform law. Among these may be mentioned the transit of large bodies of troops through the city, the frequent return of soldiers on furlough from camps where the disease had occurred, and the return of cast-off army clothing, which, in some cases at least, was infected with variolous poison, and served as fomites to propagate the disease. But it is difficult to discover any modification of these influences, apparently uniform throughout the period referred to, which can account for the great excess of variola in 1861 and 1865; and it is evident that great caution should be exercised in basing any opinion as to the probable amount of variolous disease during the next decade, upon the marked diminution during the past 3 years.

In order to offer a good chance of entirely banishing this loathsome and still fatal disease from the midst of this and other large communities, there is still needed, as was well expressed by Dr. W. Jewell,[1] "A compulsory system, under legal enactment, imposing a penalty for disobedience to its provisions, requiring every child born, or brought into the city, to be vaccinated; and making it an imperative obligation that satisfactory evidence of vaccination shall be given as a prerequisite for the admission of children into the public schools. This law, in order to operate effectually, should apply to the entire State." It is discouraging to observe, that in a community where the legislators have been wise enough to pass such a compulsory enactment—we refer to England—there are men so blind to the infinite advantages which it would secure, as to agitate for its repeal.

Mode of Communication.—During the early part of the winter of 1865, there had been, so far as I am aware, scarcely any variolous disease in the district in which the cases here recorded subsequently occurred. The origin of this little endemic was directly traceable to the influence of fomites, in the following manner: A large bale of cast-off clothing was sent to Philadelphia from one of the army posts to be worked over and made up into shoddy; and among the hands employed in the mill to which the bale was sent were two boys—Cases Nos. 10 and 30—to whom the task of picking the clothing to pieces was assigned. In addition to handling the infected clothing for hours, they both slept upon it, when exhausted by their work. I was called to visit these two lads within 36 hours of each other, and found them suffering with the initial symptoms of variola. Both subsequently presented well-marked cases, the one (No. 10) of discrete varioloid, the other (No. 30) of confluent variola; and many of the cases which I afterwards saw could be directly traced to the contagion of these two. It is not possible, however, to ascribe the epidemic of variola which prevailed in Philadelphia during that year to any one centre of contagion, owing to the influences which have been already mentioned; and it is owing to this wide diffusion of the contagious influence, that it was impossible, in so many cases, to determine the exact mode in which the disease was contracted, or the duration of the period of incubation.

In one other case (No. 28), the mode in which the disease was communicated deserves notice. The patient—a vigorous lad of 13 years—had been for some weeks under my care, suffering from a severe attack of typhus fever, from which he convalesced favourably. There was little or no variola in his immediate neighbourhood, and he had of course not exposed himself in any way to its contagion.

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[1] Report on Meteorology and Epidemics: Transactions of College of Physicians of Philadelphia.—American Journal Medical Sciences, July, 1861, p. 79.

Throughout the course of his attack of typhus, I visited him once or twice daily, and was at the same time in daily contact with numerous cases of variola. He entered on convalescence about January 15, and was allowed to walk out for a few minutes on January 28: on the following day he felt chilly, and the initial symptoms of a well-marked attack of variola immediately appeared. It is evident, either that his system did not become susceptible to the influence of the variolous contagion until convalescence was established, and that he contracted the disease during one of my visits subsequent to January 15, or, more probably, that the virus of the secondary disease was introduced to his system during the course of the primary affection, but remained dormant until convalescence was fully entered upon.

Period of Incubation.—In 27 out of these 33 cases, it was impossible to determine accurately the duration of this period: in 2, it is stated as 2 weeks, and in 3 others as exactly 12 days. In but one case—No. 10—did it seem to be less than this latter period; and here it is noted, that although it could not be accurately determined, the period of incubation appeared not to exceed 7 days.

It is not possible to assign any one definite period for the duration of this stage of variola; although in many cases, where it can be accurately determined, it appears to be 12 days precisely. That it may, however, occasionally exceed this period, is shown by the following case which came under my observation a few years ago: T. H., æt. 21, coloured, was admitted to the Pennsylvania Hospital February 22, 1866, suffering with frost-bite. He came directly from a small vessel, which had been on a voyage of some weeks, during which there had been no sickness on board. The surgical ward being full, he was placed in the medical ward. On February 27, J. L., æt. 20, was admitted to the same ward, suffering with the prodromes of some eruptive fever, and on March 1st, a papular variolous eruption appeared: the following morning he was sent to the smallpox hospital. T. H. was discharged on March 15th, cured of his frost-bite, but complaining of pain in the lumbar region; and applied for readmission March 19th, with a copious variolous eruption in the papular stage, which had appeared the preceding afternoon, 75 hours after the first complaint of pain in the back. J. L. was in the hospital 72 hours; during only 24 of which the variolous eruption was visible. There were consequently 16 days from the first exposure of T. H. to the pre-eruptive stage to the time he first complained of lumbar pain, or 14 days from the appearance of the eruption on J. L. to the first symptom in T. H.

Premonitory Symptoms.—In 20 out of 33 cases, no premonitory symptoms whatever were observed, while in 13 cases, 3 of varioloid and 10 of variola, there were some slight disturbances of health noticed. In 11 cases, there was merely languor, accompanied in 1 with nausea; and in 2 cases, marked nervous depression with chilliness and drowsiness. The cases in which these premonitory symptoms occurred were usually very severe ones.

Stage of Invasion.—The symptoms during this stage were rarely characteristic, especially in the cases of the younger children. In the patients over eight years old, however, the symptoms became more uniform and marked—consisting of a more or less pronounced chill, followed by fever of high grade, though the pulse did not usually become very rapid; severe pain in head, back, or side; slight nervous derangement; dysphagia, anorexia, vomiting, and usually constipation; congestion of the conjunctivæ in half the cases; but without any disturbances of respiration or of the urinary secretion.

There appeared to be little or no difference in the intensity of the symptoms during the early stage of cases of varioloid and variola.

Chill.—A more or less severe chill was noticed in 15 out of 33 cases; in 3 cases of varioloid and 12 of variola. The cases of varioloid occurred at the ages of 14, 14, and 15 years, and in each case the chill was marked; in one other case, at the age of 3 years, there were repeated attacks of shivering with marked nervous depression, but which did not present the features of ordinary chills. The cases of variola in which chill occurred, were at the ages of 2, 5, 6, 8, 8, 11, 12, 13, 15, 18, 18, 20 years; in 4 cases it amounted merely to chilliness; in 2 cases the chill was slight, and in 5 cases, including the one at 2 years, it was very marked.

Fever.—In all cases the initial chill was followed by fever, usually of a rather high grade. In the 10 cases of varioloid it is described as *high* in 4 cases, *marked* in 3, merely *present* in 1, and *mild* in 2; in 23 cases of variola, it is described as *high* in 5 cases, *marked* in 6, merely *present* in 11, and *slight* in 1 case. Unfortunately no thermometric observations were made, but the skin is frequently mentioned as being hot and dry. The *pulse* was invariably accelerated, though not extremely so; in 4 cases of varioloid where it is specially noted, it was 120, 115, 135, and 120 at the ages of 3, 4, 14, and 15 years respectively; in 9 cases of variola it was 140, 136, 144, 125, 144, 125, 96, 120, 120, 108, at the ages of 1, 1, 1¾, 5, 6, 8, 13, 15, and 20 years respectively.

Pain.—In all cases over 3 years of age pain was complained of, but in children under that age it was usually impossible to determine whether any pain was experienced, as in nearly all the 10 cases there was no manifestation of it. In one case of varioloid, however, at the age of 5 months, there was apparently slight pain, and in one case of variola, at the age of 6 months, there was apparently severe pain. Out of the 25 cases over the age of 3 years, the pain was *severe* in 17; merely *present* in 4; *moderate* in 2; *slight* in 1, and apparently *absent* in 1.

The pain was more frequently complained of in the head than in any other one part, though it was usually more general. Thus in 5 cases it was limited to the head, in 3 to the side, and in 1 to the back ; in 3 cases it was complained of in the head and side, in 5 in the head and back, and in 5 in the head, back, sides, and limbs.

Nervous Symptoms.—On the other hand, marked symptoms of nervous disturbance were present in comparatively few cases, and were always associated with violent pain. These nervous symptoms consisted of *delirium* in 9 cases; 2 of varioloid, at age of 14 and 15 years, and 7 of variola, the youngest of which was 7 years old ; marked *restlessness* in the first 6 cases of confluent variola, under 2 years of age, associated in one case with muscular twitching and in another, aged 2 years, with slight convulsions: *vertigo* in 1 case, marked *depression* in 1 case, and *hebetude* alone in 1 case.

The case above alluded to (No. 16) was the only one in which any convulsive attack was observed.

Digestive System.—There were, in all the cases, marked disturbances of digestion. The *tongue* was in every instance moist, and coated in the centre with a soft, light-coloured fur.

In 16 out of 33 cases there was more or less *dysphagia*, with redness of the fauces, and occasionally slight enlargement of the lymphatic glands at the angle of the lower jaw.

As, however, it was almost impossible to determine the existence of dysphagia in very young children, it renders the proportion of cases in which it was positively present, about 66 per cent. The condition of the *appetite* is mentioned in 22 cases, in 20 of which there was marked or complete anorexia, in 1 partial anorexia, and in 1 merely slight impairment of appetite. Even in cases where anorexia was complete, it occasionally did not persist throughout this stage, so that there was some slight return of appetite on the day preceding the appearance of the eruption.

Vomiting was present in 23, and absent in 10 cases. It was equally frequent at all ages; and is noted as being merely *present* or *frequent*, but in the great majority of cases it was repeated and was readily provoked by any article of food.

Bowels.—The state of the bowels is noted in all but 1 case. In 6 cases there was diarrhœa, in 13 the bowels were regular, and in 13 more or less costive. There was no unusual feature about the cases in which diarrhœa occurred to explain its presence.

Urine.—The character of the urine is noted in 23 cases, in 19 of which it was free, clear, and usually light coloured; in 3 cases it was free, but turbid from abundant deposit of urates ; and in a single fatal case of confluent variola it was scanty and turbid.

Special Symptoms.—In 10 cases, all but one of which were over 10 years of age, there was marked congestion of the conjunctivæ. This congestion was uniform, and of a dull colour, not giving to the eye the staring, bright, ferretty appearance, so often observed in the early stage of typhus fever. Apart from this condition, there was a remarkable absence of special symptoms; the only ones observed being dry cough, more or less frequent in 4 cases; and slight epistaxis also in 4 cases.

Eruption.—The phenomena of the eruption were studied with great care. The date of its appearance is noted in 32 cases, in all instances dating from the first positive initial symptom :—

In 1 case it appeared at the end of 36 hours.
In 2 cases " " 48 "
In 7 " " " 60 "
In 1 case " " 72 "
In 19 cases it appeared on 3d day.
In 1 case it appeared on morning of 4th day.
In 1 " " at end of 96 hours.

Or, in more general terms, the eruption appeared during the 2d day in 3 cases; during the 3d day in 27 cases; and during the 4th day in 2 cases. There is no difference to be observed in the date of appearance of the eruption between the cases of variola and varioloid. In 9 cases of the latter it appeared on 3d day, and in but 1 at an earlier period, namely at the end of 48 hours. In the 3 cases, however, where the eruption appeared before the 3d day, its course was irregular and the various stages were not fully developed. The part upon which the eruption first appeared was noted in 30 cases: in 22 of these, it first appeared in the face; in 4 cases, on the arms first; in 2, first on the body; and in 2, apparently simultaneously on various parts of the body.

In the cases where it appeared first on the face, its subsequent development was not uniform : in 6 cases it next appeared on the body, and then on the extremities; and in 16 cases it appeared either on the arms or legs next, and finally on the trunk.

The amount of eruption has already been indicated. In all the cases of varioloid, and in 9 cases of variola, it was discrete, and in 14 cases of variola, confluent; but there were also some peculiarities about its distribution. Thus in all cases, even where it was confluent on some parts, there were very few pocks upon the abdomen. On the other hand, it was in nearly every instance most abundant upon the face, the thighs, and the arms. In some cases, the pocks were very numerous upon the lower part of the back.

In 1 case (No. 20) of variola, occurring in a child of 5 years old, there was but one single pock, which appeared on the arm and ran regularly through all the stages of the variolous eruption, and was attended with the constitutional symptoms of a fully developed attack of variola, including marked secondary fever. A few papules appeared about seven days later, but soon aborted and disappeared. The interest attaching to this case is very considerable; for the single pock was so situated on the arm, that it might readily have been overlooked. And yet notwithstanding the very small amount of eruption, the course of the constitutional symptoms was sufficiently characteristic to clearly denote the true nature of the attack. There was, however, less abatement of the febrile symptoms upon the appearance of the eruption, than in any other of the cases of variola, excepting Nos. 11 and 12, where the rapidity of pulse and constitutional disturbance persisted until the fatal issue.

This fact then entirely confirms the view universally accepted, that the appearance of the cutaneous eruption is a sign of the establishment of an eliminative action on the part of the economy, and is consequently attended by marked relief of the symptoms of constitutional disturbance.

In all probability, the marked secondary fever which occurred coincidently with the maturation of the single pock on the skin, depended upon the evolution of a more abundant eruption on the gastro-intestinal mucous membrane. It is true that no pocks were visible in the fauces, but the frequent vomiting and marked diarrhœa which persisted during the first five or six days of the attack may probably be accepted as evidence of their presence at a lower point of the mucous tract.

The existence of a true variolous disease entirely unattended by eruption is extremely doubtful; but a case like the above renders it probable that the usual cutaneous eruption is not absolutely essential, but may be substituted entirely by an analogous affection of the mucous membranes. With regard to the frequency of this mucous eruption in non-fatal cases, the only evidence obtainable is to be drawn from the presence of marked gastro-intestinal disturbance, which can at most only be regarded as probable evidence, and from the presence of pocks on the mucous membrane of the mouth and throat. The conditions of these latter parts is noted in 28 cases, in ten of which there were no pocks seen on the mucous membranes, while in 18 there were pocks present on the lips, tongue, fauces, or pharynx. In 12 cases these pocks were very numerous, and in 7 cases the tongue was so much affected as so render mastication very painful.

The difference between the cases of varioloid and those of variola, began to be manifested in the characters of the eruption. In all the cases of varioloid the eruption was discrete and the pocks were not very numerous. But it was especially in its development that the eruption presented marked points of distinction in the respective forms of the disease.

In the cases of varioloid the papular stage was usually quite regular, and the eruption began to become vesicular on the third day; but beyond this stage, its course became irregular, and the vesicles either rapidly passed into imperfectly developed pustules, or else dried up while their contents were still serous. It may also be said, in general terms, that the pocks had not such markedly inflamed and indurated bases as the true variolous pocks, nor were they so tensely filled.

In all cases, whether the eruption was arrested in the vesicular stage or had passed into the pustular form, desiccation occurred with great rapidity, the resulting scabs were thin and frequently light coloured and desquamation began soon and progressed very quickly.

In 8 cases, where the date of the beginning of this sudden and rapid desiccation is noted, it occurred three times on the fifth day, while the eruption was vesicular; twice on the sixth day, the pocks being partly converted into pustules; once on the seventh day, when the pocks were in the same stage; and once on the eighth day, when the pocks were almost fully developed into pustules.

Desquamation began in from one to three days, from the occurrence of this sudden desiccation and was usually completed in from two to four days.

In nine of the cases of varioloid there is a note as to the existence of umbilication; it was absent in 3 cases; present in a few pocks in 4 cases; and present to a marked degree in 2 cases.

In one case, No. 8, the eruption presented the peculiar characters known as *crystalline pock;* the papules rapidly became converted into large prominent translucent bullous vesicles, the fluid of which was soon absorbed, leaving thin brown crusts. There was so much return of febrile action in this case towards the period of desiccation, as to render it uncertain whether it were a case of varioloid or of anomalous variola.

On the other hand, the eruption was regular throughout all its stages in no less than seventeen out of the twenty-three cases of variola. In one other case, the papules were short-lived, and umbilicated vesicles were to be seen on the third day of the eruption, but its subsequent stages were quite regular.

The stages of desiccation and desquamation also presented many irregularities. In 11 of the above 18 cases of non-fatal variola, the date of the beginning of desiccation is noted; in one case it was on the 8th day of the eruption; in 4, on the 9th day; and in 6, on the 10th day. The duration of desiccation also varied greatly: in 1 case it was but 2 days until desquamation began; in 4 cases, it was 3 days; in 2, 4 days; in 1, 7 days; in 1, 8 days; and in 1, 10 days. Accordingly, the beginning of desquamation, which is noted in twelve cases, occurred in 1 case on the 11th day of the eruption; in 1, on the 12th day; in 7, on the 13th day; in 2, on the 17th day; and in 1, on the 20th day. The duration of this last stage varied from 3 to 12 days; and in 11 cases, where its date of completion is noted, this occurred in 1, on the 15th day; in 1, on the 16th day; in 1, on the 19th day; in 3, on the 20th day; in 3, on the 25th day; in 1, on the 29th day; and in 1, not till after the 30th day.

Age had comparatively little influence upon the date of the completion of desquamation; the cases in which it was furthest postponed, to the 29th and 30th days, were in children aged 6 and 12 years respectively. In all those cases, however, where *desiccation* occurred slowly, *desquamation* was also tardy. Among these 18 cases, in which the course of the eruption was regular, there was but 1 (No. 18, where death occurred on the 13th day from croup) which proved fatal.

In addition to these 18 cases, however, there were 5 others, in all of which the eruption was irregular. These latter all occurred in young children, their ages being respectively 6 months, 9 months, 1, 2, and 4 years; and in all but one case, the attack proved fatal.

In 3 of these cases, the eruption suddenly shrivelled at the 8th, 4th, and 14th days respectively, there was an effusion of blood into the pocks, and at the same time ecchymoses appeared over the surface of the body and especially in the flexures of the joints. In these cases, death rapidly occurred with all the symptoms of profound depression. In one other, aged 4 years, the pocks after developing into pustules, suddenly shrivelled on the 9th day of the eruption, and the child steadily sank and died, on the 14th day of the disease, from debility. In the last case, aged 2 years, the attack was a mild one; desiccation began on the 8th day, and desquamation on the 10th, and was completed by the 15th day.[1]

In all 23 cases the vesicles were umbilicated. In 19 cases very many pocks presented this condition to a marked degree; in 3 cases it is merely noted as being present, and in one case only a few pocks were umbilicated.

The peculiar odour, usually described as characteristic of severe variola, was present in but a few cases, and indeed it is only twice specially noted.

Symptoms during the Papular and Vesicular Stages.—The phenomena during this period of the disease were quite uniform in the cases of both varioloid and variola.

In nearly every case (26 out of 30 in which this point is noted) there was a marked and immediate subsidence of the fever and of all the constitutional symptoms upon the appearance of the eruption: in one case this did not occur until 24 hours afterwards. This subsidence was observed even in case No. 20, where there was but a single papule, though here it was only to a slight degree: and in one other case (No. 11), a fatal attack of confluent variola, there was also but slight abatement in the general symptoms. In but a single case (No. 12), also a fatal attack of confluent variola in an infant, was there no diminution in the intensity of the constitutional symptoms upon the appearance of the eruption.

The subsidence of the fever manifested itself by a rapid diminution of the heat of the skin, restlessness, pain and sleeplessness, and by cessation of the vomiting.

The symptom which showed least change, especially in the very young children, was the frequency of the pulse. Thus in Nos. 2 and 3, cases of discrete varioloid, at the ages of 3 and 4 years respectively, the pulse continued at the rate of from 120 to 148 in the one, and of 115 in the other. So in 5 of the first 11 cases of variola in which the pulse-rate is noted, it was 165 to 180 in a fatal case of confluent variola at the age of 6 months; the same in a similar case at 9 months, and over 130 in 3 favorable cases at the ages of 21 months, 2 and 6 years respectively.

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[1] This case (No. 17) might, perhaps, have been as accurately placed among the cases of varioloid.

In cases occurring in older children, however, the pulse almost invariably became much less frequent, falling in the course of 24 hours to 108, 90, 84, or even 72.

The nervous disturbances usually subsided with the fever, and in 7 cases only were any such symptoms observed during this period of the disease. These consisted of great restlessness and muscular twitching in the first two cases of variola; of delirium for 24 or 36 hours in Nos. 26 and 31, both of whom had presented marked delirium during the stage of invasion; and of slight hebetude with drowsiness in three cases. In all the other cases, whatever nervous symptoms had been present immediately subsided. In but a single case, No. 25, where there had been very severe headache with delirium, is the persistence of pain during this stage noted.

It is noted that, with the exception of occasional dry cough in 4 cases, bronchial symptoms were entirely absent during the stage of invasion. During the period following, however, they became comparatively frequent and evidently depended upon the irritation of the mucous membrane due to the presence of the eruption in the fauces, and in some cases probably in the air passages themselves. In 18 cases they are noted as absent; among the other 14 cases there was slight dry cough in 9, and in 5 frequent cough, with dry or moist rales in the lungs, and occasionally with marked difficulty of respiration. In but one case, No. 11, did this pulmonary complication appear to be sufficiently grave to have any principal share in causing death.

The digestive derangements, which had been marked during the previous stage, disappeared in the great majority of cases. The tongue was, with three or four exceptions, moist and clean, or only lightly furred; vomiting was absent in all but 4 cases; and in 30 cases, where the condition of the bowels is noted, they were regular in 20, constipated in 7, and in but 3 was diarrhœa present. In these three latter cases there had been diarrhœa from the beginning of the attack. In most of the instances also there was at least some return of desire for food, and in 10 cases there was very fair appetite. It will be remembered that in 18 cases there were pocks present on the lips, tongue, or fauces, and in 16 of these cases marked dysphagia persisted throughout the stage now under consideration, and frequently prevented those patients who strongly desired food from taking it in any quantity. The great difference in intensity which existed between the inflammation of the skin in variola and varioloid was shown markedly by the fact that subcutaneous swelling was absent in all cases of the latter excepting one where there was a slight degree of it, while it was present in all but 3 cases of variola, to a marked or even extreme degree in 12, to a moderate degree in 6, and slightly in 2 cases. The parts most affected by this œdema were the face, the neck, and in a few cases the extremities. The features were in some instances so swollen as to render the patient utterly unrecognizable, and in other cases the œdema of the neck was so extreme as to aid materially in rendering deglutition difficult.

The state of the urine is noted in 19 cases, in 15 of which it was of good quantity, and clear without any marked deposit; in 1 case it was profuse on the 2d day of the eruption; in 1 case it was clear but rather scanty; in 1 case it was free but turbid from a large deposit of urates, and in 1 case (No. 6) of discrete varioloid, the urine, on the 5th day of the eruption, contained albumen, blood, and granular tube casts; on the 6th day it was almost suppressed and the pulse had fallen to 65; on the 8th day it still contained a little blood, but by the 10th day was entirely healthy. In the only case in which the amount of chlorides was tested, they were markedly deficient.

One of the most distinctive features between varioloid and variola is the secondary fever or fever of maturation, and accordingly the presence and peculiarities of this were noted carefully in every case.

In 8 of the 10 cases classed as varioloid there was no perceptible return of febrile action after its subsidence upon the appearance of the eruption. In one case, No. 2, there was a very slight return of fever on the 5th day; and in one other, No. 8, in which the eruption presented the peculiar characters of crystalline pock, there was a very marked return of febrile action coincident with the desiccation of the large bullous vesicles.

In the 23 cases of variola, on the other hand, the occurrence of secondary fever is noted in all, excepting 3 fatal cases, Nos. 12, 13, and 18. In 15 cases it was very marked; in 2 cases, moderate; and in 3 cases, the increase of febrile action was slight.

In the first 2 of the fatal cases in which the secondary fever was absent, the eruption did not develop at all, but became hemorrhagic, and death occurred on the 7th and 9th days of the disease respectively. In the 3d case the eruption developed regularly until the 12th day, and no reason can be assigned for the non-occurrence of maturative fever, excepting the profound prostration of the vital forces.

The date of the beginning of the secondary fever is noted in 14 cases, in one of which it appeared on the 5th day of the eruption, in 6 cases on the 6th day, in 6 cases on the 7th day, and in 1 case on the 8th day. Its duration bore a definite relation to the date of its appearance, being longer when it began early, and shorter when it was not developed until a later period. The extremes of its duration were two and four and a half days, but in the great majority of cases it lasted about three days, and then more or less quickly subsided.

During its continuance, there were marked and often violent febrile symptoms; consisting of extreme restlessness with muscular twitching, general soreness of the body, and, in some few cases, delirium; the heat of skin was very high, and the pulse irritative in character, weak, and even more frequent than during the initiatory fever, reaching 130 in some of the older patients, and being noted as too rapid to count in several of the young children. The appetite again declined in most cases, the bowels had a tendency to become constipated, and the urine was usually noted to become scanty and much darker in colour. During the decline of this secondary fever, all the symptoms of constitutional disturbance rapidly subsided, the eruption desiccated more or less quickly, and the patient soon entered upon convalescence.

A certain amount of constitutional irritation was maintained, however, by the presence of the crusts, which were a constant source of annoyance, exciting intolerable itching, so that the patients could not, in many instances, be restrained from tearing the scabs off with their nails, leaving small, raw, bleeding ulcers.

The only symptom, however, during the decline of the disease, which merits special attention, was the condition of the *urine*, which, in a number of cases, underwent a sudden and, apparently, critical increase in quantity after the beginning of desiccation.

This increase in the amount of urine was observed in but a single case of varioloid, No. 9, where the eruption was limited to a half-dozen papules, which became vesicular, and dried up on the fifth day after appearing. On the second day of the eruption, there was a profuse discharge of clear watery urine, followed by a rapid subsidence of all the constitutional symptoms.

The apparent relation between the cutaneous eruption and the secretion of urine is, however, shown more forcibly in some of the cases of variola.

In no less than 8 out of the 18 cases which recovered, it is noted that during desiccation, there was a very rapid and marked increase in the amount of urine. The quantity is usually spoken of as profuse, but in 3 cases it was accurately measured: in case No. 28, a boy, aged 13 years, the amount, on the 12th day of the eruption, was f℥xlv; and in case No. 22, a girl, aged 18 years, the daily amount of urine passed from the 10th to the 13th day of the eruption was f℥clx, or 10 pints, of sp. gr. 1001, as clear as spring water, containing no albumen, but with a fair proportion of chlorides. In case No. 33, a young man aged 20 years, the urine became very copious after the 11th day of the eruption, and on the 18th day he passed f℥clx of crystal clear urine, of sp. gr. 1007, without albumen, but containing abundant chlorides. Coincident with this remarkable increase in quantity of urine, there was not only rapid desiccation of the eruption, but a correspondingly rapid diminution in the amount of the subcutaneous œdema.

As tending to further illustrate the obvious connection between the rapid process of desiccation and this abundant secretion of watery urine, case No. 27 may be quoted. This patient, aged 12 years, had presented very marked secondary fever, with great subcutaneous swelling, and dark scanty urine. On the subsidence of the secondary fever, the urine became slightly more free, but on the 12th day of the eruption, she had a chill, the urine contained a little albumen, was milky, from a deposit of white crystals of uric acid, and presented a deficiency in the amount of chlorides. Desiccation was remarkably slow, and was not completed for seven days; the pocks formed thick tallow-like crusts, which had not completely desquamated by the 27th day. It is highly probable that, in this case, owing to a sudden attack of renal congestion on the 12th day, the kidneys were incapacitated from secreting freely; there was no rapid removal of fluid from the economy, and, in consequence, the fluid was not rapidly absorbed from the pustules, so that desiccation was rendered tedious and imperfect.

To those who have no objection to the classical term "critical discharge," the above instances of profuse secretion of watery urine will certainly appear to fairly merit that name.

Diagnosis.—The chief interest in connection with this point lies in the differential diagnosis of the disease during the stage of invasion. In all cases where the eruption appeared and developed regularly, any probability of error was quickly removed.

During the stage of invasion, however, as has been already seen, there were few characteristic symptoms in the cases occurring in infancy; and, indeed, it was principally the knowledge of the exposure to variolous contagion that enabled the character of the coming disease to be foretold. In older patients, however, the history of the case was greatly aided by the frequent occurrence of congestion of the eyes, dysphagia, vomiting, unusually severe pain, with but little cerebral disturbance, and without excessive acceleration of the pulse.

Apart, however, from these positive symptoms, which in many cases were so markedly present as to justify a direct symptomatic diagnosis, there was such an absence of the characteristic symptoms of the other exanthemata, as would frequently lead to a correct diagnosis by exclusion.

From the invasion of scarlatina, the discrimination was aided by the more moderate heat of skin and acceleration of the pulse; by the comparatively slight swelling of the cervical glands; by the presence of congestion of the eyes, and by the greater intensity of the pain; but, in several cases where the fever was very high, and the throat symptoms marked, it was only the greater duration of this stage, and the ultimate appearance of a papular eruption that established the diagnosis.

From the stage of invasion of rubeola, the diagnosis was, in most cases, readily made by the difference in the appearance of the eyes, which were less *suffused* and not *watery*, as in rubeola; by the absence of sneezing or coryza; by the rarity of the cough, which, when present, was rather dry and hacking than hoarse and scraping; by the greater intensity of the pain, and especially of that in the loins; by the presence of dysphagia; and finally, by the character of the papules, which were small and shot-like, instead of presenting the softer, flatter, and broader characters of the rubeolous eruption.

In several cases where there was epistaxis, but especially in No. 24, where there was repeated epistaxis, associated with diarrhœa and cough, there was some hesitation in deciding against the possibility of the disease being typhoid fever. This doubt was, however, removed, by attention to the mode of the attack, which was far more sudden than is usual in typhoid fever; to the violence and seat of the pain; to the faucial character of the cough and the dysphagia; even before the appearance of the eruption on the 3d day, conclusively settled the question.

The question of *prognosis* must be considered under two aspects: as controlled by general influences, or by the special symptoms of each individual case. From the first point of view it is evident that the prognosis must be unfavourable in direct proportion to the youth of the patient, all the deaths which occurred being in children of four years of age or under; and again, that the mere fact of the previous successful vaccination of the patient is sufficient to render the prognosis almost absolutely favourable as regards life; though the severity of the attack, its duration, and the probability of disfiguration will be in inverse proportion to the degree of the protective influence still exerted by the vaccination.

Among the special symptoms which must be regarded as unfavourable, rank first certain peculiarities in the eruption, as its confluence, its tardy appearance, imperfect and irregular development, hemorrhagic condition of the contents of the pocks, associated with petechiæ or ecchymoses, or its recession or shrivelling at any stage of its development.

The continuance of the fever, or its very slight subsidence only, after the appearance of the eruption, with persistent rapidity of pulse (Nos. 11 and 12), are also very unfavourable conditions.

The excess of any one set of symptoms, as the bronchial (No. 11), the cerebral, or the faucial, or digestive (No. 21), is of course highly unfavourable as complicating the regular course of the disease.

On the other hand, it may be said that the prognosis is highly favourable in all cases of variolous disease, whether modified by previous vaccination or not, which occur after the age of four or five years, and which present no marked irregularity in their symptoms, and no serious complications.

Complications.—Among the list of complications which frequently occur during variola, there are but few noticed in the cases which form the basis of this article.

Ophthalmia of a quite severe form, but yielding to mild treatment, was observed in 3 out of the 28 non-fatal cases.

Albuminuria of a temporary character, accompanied by the presence of blood and tube casts in the urine, and due to renal congestion, was present in one case (No. 6) from the 5th to the 9th day of the eruption. This condition of urine was associated with recession of the eruption and marked slowness of the pulse (66 in the minute, in a boy of 11 years old), but disappeared apparently under the influence of active counter-irritation over the kidneys, and the use of saline purgatives.

Metrorrhagia was noticed during the first twelve days of a very severe attack of confluent variola in a girl (No. 31) æt. 18, who was menstruating at the time of the attack. There was no other evidence whatever of a hemorrhagic tendency in the disease.

In No. 26, on the tenth and eleventh days of the eruption, the patient had a well-marked chill, followed by high fever, slight delirium, and subsiding with sweating. Occurring during the process of desiccation, these chills suggested the possibility of pyæmia having ensued, but fortunately their recurrence was entirely prevented by antiperiodic doses of sulphate of cinchonia, and no reasonable doubt remains that the case was merely complicated with the malarial poison, which manifested itself in the form of quotidian intermittent so soon as the evolution of the variolous virus was completed.

Among the five fatal cases, one (No. 11) was complicated with congestion of the lungs; and in one other (No. 18) symptoms of croup supervened on the thirteenth day and rapidly proved fatal. There was no expectoration of false membranes, nor was it possible to obtain a very clear view of the fauces to determine the presence of pseudo-membranous deposit there, and as no autopsy was permitted, it is impossible to decide whether the symptoms were really due to true croup or merely to œdematous laryngitis.

In two cases (Nos. 11 and 21) there was such marked opposition to taking any food as to constitute a very serious complication. In the former case there was no doubt that it materially aided in causing the fatal result; while the latter patient, whose case will be detailed under the head of treatment, was sustained for several days solely by whiskey, which she fortunately was willing to drink freely.

Results.—The results of these cases have been so frequently alluded to in discussing the effect of age and vaccination upon the mortality, that it is sufficient to state here that all the cases of varioloid recovered; that of 23 cases of variola, 5 died, being a mortality of 21.7 per cent.; or taking the entire series of 33 cases, a mortality of a trifle over 15 per cent. Of 10 cases of variola, 9 confluent and 1 discrete, occurring within the first five years of life, 5 or 50 per cent. were fatal; and of 4 cases, all confluent, occurring within the first year of life, 3 or 75 per cent. were fatal; while of 13 cases occurring between the ages of 5 to 20 years, not one was fatal.

Duration.—The duration of the attacks was in all cases measured from the initial symptom to the establishment of undoubted convalescence.

In the 10 cases of varioloid the mean duration was 9.8 days; the extremes being respectively 6 and 16 days.

In the 18 favorable cases of variola the mean duration was 19.3 days, or almost exactly twice that of the cases of varioloid, while the extremes were respectively 15 and 24 days.

In the 5 fatal cases of variola the duration was respectively, 16, 7, 9, 16, and 14 days—the mean being 12.4 days.

The causes of death have been already adverted to. In the two cases which proved fatal at the end of 7 and 9 days, the principal cause of death was the malignancy of the attack as evidenced by profound prostration of the vital forces, and by the hemorrhagic character of the eruption. In addition to this there was almost entire inability to swallow. In case No. 11, a little girl aged 6 months, the cause of death on the 16th day was chiefly congestion of the lungs, aided powerfully by marked indisposition, and, indeed, inability to take nourishment.

In case No. 18, the attack, although very severe, and although the patient was entirely neglected, was apparently progressing quite favourably until the 13th day when symptoms of laryngeal obstruction supervened and death occurred, either from pseudo-membranous croup or œdematous laryngitis, in about 72 hours.

In the remaining fatal case, No. 19, the attack was characterized from the beginning by marked debility; the eruption did not all develop, but on the 9th day of the eruption the sero-pustules on the extremities shrivelled, while those on the face maturated and desiccated regularly. Subsequently, despite free stimulation, the child steadily sank and died on the 14th day of the disease.

Sequelæ.—In all save the fatal cases, convalescence was rapid and the recovery complete, and unattended by any sequelæ, excepting, in a very few instances, more or less disfiguration.

Disfiguration.—No permanent disfiguration was caused in any of the cases of varioloid, the cutaneous inflammation being comparatively superficial, and the crusts, on separating, leaving merely small erythematous spots where the epiderm was soft and delicate.

Among the 18 favourable cases of variola, there were five in which disfiguration resulted, in three of which it was very marked, in one slight, and in one so trifling that it could scarcely be detected, and would in all probability be only temporary.

In all of these cases where disfiguration resulted, the eruption was confluent, but a further consideration will show that the amount of the eruption was not the only important influence in determining its frequency and degree.

Thus, it will be observed that in 10 cases no local application was made to the face to prevent pitting, while in the other 8 cases, some such application was employed. Among the 10 cases in which no preventive application was made, there were 5 of discrete variola, in none of which did any disfiguration ensue; and 5 of confluent variola, in 3 of which marked pitting followed. It is interesting to note that 3 of these 5 cases of confluent variola occurred within the first two years of life, and that but one of them (No. 11) was disfigured, while both the other cases, one 6, and the other 18 years of age, were severely pitted. It would appear from this, as would indeed seem probable from other considerations, that the danger of pitting from the variolous eruption is much less in early infancy when the reparative activity of the skin is so remarkable. In No. 11, however, where death occurred on the 16th day from congestion of the lungs and debility, it was noticed that wherever the crusts had been rubbed off, deep pits were left.

One of the other two cases where pitting occurred, No. 32, was not seen until too late to make any local application with hope of benefit, but the only excuse for neglecting such preventive treatment in the other case, No. 21, is that the child was so horribly ill that it appeared almost impossible for recovery to take place, and very undesirable to do anything that could disturb or annoy her in the least degree. It is, however, I think, much to be regretted that the solution of gutta percha was not freely applied over the face.

Attention has been already called to the fact, that in No. 32, where marked pitting ensued, the patient, a young and good-looking woman, had been successfully vaccinated when a young child.

Turning now to the group in which local applications were made, there are 8 cases; 4 of confluent, and the same number of discrete variola, all of the patients being 8 years or more of age.

In but two cases did any pitting occur, in one of them, No. 30, to a slight degree, and in the other, No. 33, a most violent case of confluent variola, to so trifling a degree that the scars could scarcely be detected, and would, in all probability, disappear entirely in a short time. It appears, therefore, that the local applications employed certainly had the effect of very greatly diminishing the degree of disfiguration, if not of entirely preventing it in a majority of cases.

The local applications used were, in 2 cases of discrete and 1 of confluent variola, mercurial plaster spread on a muslin cloth and applied as a mask to the face, holes being cut for the eyes, the nostrils, and mouth; and, in 2 cases of discrete and 3 of confluent variola, a saturated solution of gutta-percha in chloroform painted over the face until a quite thick layer was formed.

In estimating the comparative value of these two applications, the data are very meagre; yet it will be observed, that in the only case of confluent variola in which mercurial plaster was used, there was some slight disfiguration, while out of 3 severe confluent cases in which the gutta-percha was applied, there was not the slightest pitting in 2 cases, and but a very slight degree of it in the third.

The precise action of this latter application is carefully noted in 5 cases. In one, No. 26, it was applied thoroughly to the face before the appearance of the eruption, and it is noted that although the eruption was confluent on that part, it never fully maturated, but desiccated some days before the pocks on any other portion of the body.

In the other cases, Nos. 27, 28, 29, and 33, the application was made during the vesicular stage; in Nos. 28 and 29, on the sixth day of the eruption.

In one of them, No. 29, when the eruption on the body was highly pustular, the pocks on the face were small and whiter, and desiccated much more rapidly than the pocks elsewhere. In the other cases, the application did not prevent the maturation of the pocks, nor lessen the duration of desiccation and desquamation, but still, judging from the immunity from pitting, it would appear to have modified the severity of the cutaneous inflammation in each instance. It is of course obvious, that the full beneficial effects of such local remedies can only be expected in cases where the application has been made at a very early period of the eruption.

Treatment.—The treatment was purposely very uniform so far as concerns the remedies employed. These consisted of a febrifuge diuretic mixture, sulphate of cinchonia and whiskey, in almost all the cases; with a few other drugs, which were used only in exceptional cases.

The febrifuge mixture was as follows: Potass. acet. gr. xl, sp. ætheris nitrosi f℥j, liq. ammoniæ acetatis f℥iij, ft. sol., with the addition, in cases of young children, of a little ginger syrup; of this solution, from a teaspoonful to a tablespoonful was given, according to the age of the child and the degree of fever, from four to eight times daily. It appeared to relieve the intense thirst and sense of heat, and may have been concerned in promoting the profuse secretion of watery urine which in so many cases attended the subsidence of the secondary fever. In most of the cases of varioloid, the use of this mixture, with the regulation of the diet, constituted the entire treatment. In 4 cases, some preparation of cinchona was used; in very small doses in Nos. 2 and 11; while in Nos. 4 and 10, aged 8 and 15 years respectively, where the constitutional symptoms were more severe, sulphate of cinchonia was given in doses of gr. iv and gr. xij daily.

In all the cases of variola under 2 years of age, excepting No. 8, which was not seen until the day before death, tr. cinchon. comp. was given in doses of ♏xv every three or four hours; while in the cases above that age, with two exceptions, where tr. cinchon. comp. was used, sulphate of cinchonia was given, in the form of solution, in doses of from gr. iv to gr. xij, according to the age.

In all of these cases, this drug was administered purely as a general muscular and cardiac tonic, the most alarming symptom in many instances being the marked tendency to debility and failure of the powers of the circulation.

In No. 26, however, which was complicated with quotidian intermittent fever appearing on the 11th day, the amount of cinchonia taken, which had been gr. viij daily, was immediately increased to gr. xx, with the desired effect of checking the malarial paroxysms.

Stimulus.—In only two cases of varioloid was any whiskey given: No. 2, where f℥ij daily were given; and No. 10, where the amount taken was f℥xij daily.

In No. 2 the stimulus was indicated by the very rapid and feeble pulse persisting after the appearance of the eruption: the amount given was well tolerated, and the child made a very rapid convalescence.

In No. 10 there had been unusually severe nervous symptoms, with complete anorexia and great debility, and the pulse remained frequent, 120, after the appearance of the eruption. Under these circumstances, the amount of stimulus was rapidly increased until the patient, a lad of 15 years, took f℥xij whiskey daily. It was observed, however, that the rapidity of the pulse persisted until the 16th day, and that the date of convalescence was unusually late, so that I think it may be fairly questioned whether the amount of stimulus was not excessive and did not tend to prolong the attack.

All of the cases of variola, under 5 years of age, took f℥ij whiskey daily. One of these cases, however, No. 18, was only under treatment for a few hours, and was moribund when first seen. Of the other 9 cases, 7 were confluent and 2 discrete; 5 recovered and 4 died. In every instance the stimulus was willingly taken, retained, and appeared to produce favourable effects. The chief object in its administration was to stimulate the circulation and maintain the cutaneous eruption. Its influence in this direction was well shown in No. 15, where, on the 8th day, the eruption on the face receded, leaving wrinkled and partly dry crusts; but under the influence of active stimulation (f℥ij whiskey daily) the vesicles refilled and maturated regularly.

In the cases over 5 years of age the amounts given were as follows:—

Case 21,	female,	æt. 6,	f℥ij ad viij daily.
" 22,	"	" 7,	not noted.
" 23,	"	" 8,	not noted.
" 24,	male,	" 8,	f℥viij daily.
" 25,	female,	" 8,	f℥j daily.
" 26,	male,	" 11,	f℥iv ad vj daily.
" 27,	female,	" 12,	f℥iv ad vj daily.
Case 28,	male,	æt. 13,	f℥iv daily.
" 29,	"	" 13,	
" 30,	"	" 15,	f℥xij daily.
" 31,	female,	" 18,	f℥xviij daily.
" 32,	"	" 18,	f℥xij daily.
" 33,	male,	" 20,	f℥iv ad vj daily.

It will be readily seen from the above table that, although whiskey was used in every case, it was not given without careful reference to the state of the patient. The symptoms which were recognized as indications for its administration and as regulating the amount to be given were, the abundance of the eruption ; any tendency to its recession, any irregularity in its development, or a hemorrhagic appearance of the pocks ; disturbances of the nervous system as shown by great restlessness, with or without muscular twitching or delirium ; rapidity of the pulse, especially when associated with smallness and feebleness.

There were also two other conditions which appeared to call for largely increased amount of stimulus.

The first of these was the almost entire inability and unwillingness of some of the little patients to take nourishment, under which circumstances it happened more than once, that they would greedily drink wine or whiskey freely diluted with sweetened water.

The subjoined case is quoted to show the beneficial effects of free stimulation in such a condition.

CASE 21.—Mary O., æt. 6, previously healthy, was directly exposed to the contagion of cases of malignant variola, and after 12 days' incubation, was, on the afternoon of December 28, 1864, seized with violent pain in head and back, without dysphagia, but with marked nausea and vomiting.

December 30. No eruption had appeared. Violent inflammation of right eye, with chemosis, and great redness and œdema of tissues about orbit. The cervical glands were slightly enlarged; the tongue moist, coated white, with no enlargement of its papillæ. Pulse 144 and feeble; respirations rapid. The intelligence was perfect. Bowels very costive; urine free and clear.

Ordered sulph. cinchoniæ gr. jss, q. q. h.; beef-tea, whiskey f℥ij daily in milk, and frictions with capsicum to the surface.

31*st*. Has passed a bad night, suffering with restlessness, nausea and vomiting; bowels not opened; right eye more inflamed. No cough or dysphagia. Heat of skin less; pulse 145, very small. During the night numerous small papules have appeared at various points of the surface.

Ordered enema containing f℥ss ol. ricini. Frictions to be continued; lime-water to be added to milk punch, and mustard plaster to be applied over stomach to relieve nausea, and tr. opii camph. fʒss to allay pain and procure sleep.

January 1. Has passed a good night, and eruption coming out well, especially on the left cheek. Skin moderately hot; pulse 130. Tongue dryish and nausea less, but with anorexia. Bowels opened slightly by the enema.

2*d*. Has passed a fair night, but obstinately refuses to take any nourishment, and at 1 A.M., had a syncopal attack, with falling of the temperature and very imperfect reaction. Eruption well out, beginning to assume an umbilicated vesicular appearance. Right eye no worse. Slight dysphagia; tongue dryish.

3*d*. Eruption developing well, many of the pocks being vesicular and umbilicated; it is confluent on the face, and there are numbers of pocks on the tongue. Pulse 130; respirations easy; bowels spontaneously and freely opened. Urine free, with large deposit of urates. After being forced once or twice, she now takes milk punch, mutton broth, and sulph. cinchonia gr. v daily.

4th. Fifth day of eruption. Eruption confluent on face and parts of arms; but few pocks on the trunk; contents of vesicles whitish and opaque. Eyes entirely closed; enormous swelling of neck. A great number of pocks have developed in mouth, causing extreme dysphagia. Tongue very dry, and she again obstinately refuses to take any nourishment; the only thing which she will swallow is lemonade, which disguised the taste of the cinchonia. Has passed a very bad night. Bowels costive; urine free. Respiration sighing; pulse 145, and very feeble. Ordered nutritious enemata of beef-tea f℥j with whiskey fʒij.

5th. Eruption maturating; secondary fever still marked; pulse 140; respirations, 25. Two enemata were given, but were not long retained; but she is now willing to drink whiskey mixed with lemonade, and takes f℥viij of it in course of the day.

6th. Refuses mixture of cinchonia and lemonade, but still drinks whiskey, f℥viij, in lemonade, during 24 hours. She is also willing to drink a little weak beef and barley soup. Has passed a fair night. Pulse still 144, but with rather more strength. Tongue moist, and covered with pustules. Swelling of neck less. Bowels quiet. Urine free and clear. The eruption is progressing well; on the face and extremities it is confluent, of a yellowish-white colour on face, still pearl-coloured on the extremities; on the trunk the eruption is discrete.

7th. Decidedly better. Desiccation has begun on face. Pustules fully developed on body, but on extremities their contents are still sero-purulent. Secondary fever declining. Has passed a fair night. Pulse 130, with increased strength. Cervical œdema diminishing. Tongue dryish, smooth, the pustules on it have desiccated. Bowels quiet. Urine free and clear. She is willing to take a little more soup. Still takes whiskey f℥iij daily. Ordered syr. rhei aromat. fʒiij.

8th. 9th day of eruption. Desiccation advancing on face and neck. Pulse 120.

11th. 12th day of eruption. Desquamating on face. Pulse 108. Appetite good and eats freely. Functions all regular.

12th. Improving rapidly. Reduced whiskey to f℥iv daily.

13th. Pulse 120. Slight increase of heat of skin.

17th. 18th day of eruption. Pulse 108. She is entirely convalescent, though desquamation is not completed.

25th. 26th day of eruption. Desquamation complete, but there is considerable disfiguration from pitting.

Although this child took a little weak meat soup on January 6th and 7th, the quantity was quite insignificant, and it is not too much to say that she was sustained during three days almost exclusively by half a pint of strong whiskey daily. In the course of eight days, this patient, but six years of age, took 64 ounces of this liquor, and there can be no doubt that it was the principal cause of the favourable termination of the case. Although far from being an advocate for indiscriminate and excessive stimulation in disease, I am still convinced that we are yet far from appreciating the full extent of the beneficial influence of alcoholic stimuli in the acute diseases of childhood, an influence of which no better example than the above quoted case could be demanded.

The other condition under which large amounts of stimulus were given with marked advantage, was in cases where the secondary fever was severe and attended with great nervous disturbance. Thus, in Cases 31 and 32, both young women aged 18 years, and in both of which there was at this stage delirium, great restlessness and insomnia, high temperature and rapid pulse, the daily amount of whiskey taken was f℥xviij and f℥xij respectively; and in each case, with the most markedly beneficial effect.

The only form of stimulus used was whiskey (excepting a little sherry wine in a few cases for a day or two) and in every case it was administered in the form of milk punch, 2 parts of milk, to 1 of whiskey, with the addition of a half part of lime-water, when nausea or vomiting was present. This punch was given in small quantities, from f℥ss to f℥ij, according to the age and the amount of stimulus used, every two, three, or four hours.

The only special symptoms or complications which required treatment, were ophthalmia, insomnia, pain and restlessness, nausea and vomiting, and the constipation which was so frequent. In no cases, fortunately, did any pocks form on the ocular conjunctiva, and the only treatment adopted for the conjunctivitis was careful syringing with lukewarm water, and the instillation under the eyelids of a weak collyrium of acetate of lead and vin. opii. Opium was given freely, in full doses, at any stage of the disease, when the nervous restlessness or the pain were so marked as to prevent refreshing sleep. It was, however, especially during the stage of secondary fever that it was indicated, and when its administration was followed by the most delightful effects. In cases occurring since those tabulated above, bromide of potassium has been given in large doses during the maturative fever, and in most instances will be found to act admirably in quieting agitation and securing refreshing sleep.

The nausea and vomiting were treated by the external applications of sinapisms over the stomach, and by the administration of small fragments of ice, and of small quantities of lime-water and milk.

In the cases where the bowels were constipated, repeated doses of the tincture, or the aromatic syrup of rhubarb, aided in their action by enemata, at times containing ol. ricini, were given so as to secure at least one full evacuation every 48 hours. In only a very few instances was there such a degree of diarrhœa as to need checking; but when present, it yielded readily to the use of small doses of chalk and opium.

The treatment adopted in the only case where renal symptoms appeared (consisting of scanty, high-coloured urine, containing albumen, blood, and tube casts) has been already mentioned. The sulphate of cinchonia, and tr. ferri chloridi, which the patient was already taking, were continued, and in addition counter-irritation over the kidneys, and active purgation by saline cathartics were employed. Under this treatment the symptoms rapidly disappeared, and the urine resumed its normal character in three or four days.

The diet was invariably of a highly nutritious, though readily digestible character, and consisted chiefly of milk, with or without the addition of some farinaceous preparation, as arrowroot or farina; beef-tea, or the cold extract of beef prepared according to Liebig's formula; other meat broths with the addition of a little rice or barley; eggs beaten up with wine and milk; milk punch prepared in the manner already mentioned.

In the cases occurring during the first two years of life, the diet was restricted to milk, beef-tea, and weak milk punch.

After the subsidence of the secondary fever, iron, usually in the form of tr. ferri chloridi, combined with sp. ætheris nitrosi, was prescribed, and its use continued, in conjunction with small doses of sulphate of cinchonia and nutritious diet, throughout convalescence.

The above sketch of treatment is drawn rather from the non-fatal cases, but is applicable also to the fatal ones, excepting that as the vital powers failed in these latter, the amount of bark and whiskey was largely increased, and external stimulation was resorted to, in the form of hot blankets, or frictions with capsicum. In one case, No. 13, where the eruption became hemorrhagic, ol. terebinth. was given in emulsion in doses of gtt. ij q. q. h., for 36 hours preceding death.

All possible precautions were observed in the general management of the cases. Isolation was insisted upon wherever practicable, or if impossible, all those exposed to the contagion were immediately vaccinated, even though that operation had been performed but a single year before. The sick chamber was freely ventilated, and the air disinfected by the liberation of chlorine from chlorinated soda. It cannot be doubted that by the adoption of these precautions, the spread of the disease was prevented in a very great number of instances, for nearly all of the cases occurred in such circumstances that large numbers of children and adults were within the range of contagion.

It is to be regretted that no opportunity was afforded for determining the morbid appearances in the five fatal cases, but the prejudices of the relatives in every case prevented the performance of an autopsy.